

Understanding the Emotional and Psychological Reflections of the Engineering Students on the Remote Teaching as a New Pedagogical Practice

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Abstract: The conventional classroom methods of instruction in engineering education have been transformed into online lectures or remote teaching in recent months. This sudden transformation of pedagogy has largely influenced the cognitive ability of the students including emotional and psychological attributes. Therefore it has become necessary to understand the students' reflections on this pedagogical transformation towards making remote teaching more learner-centric. The present study manifests the emotional and psychological challenges experienced by the students during online learning. An anonymous online survey has been conducted to collect actual data. The survey has been conducted for all the students from 3, 5, and 7 semesters at the Department of Civil Engineering degree course offered by the Marwadi University, Rajkot, Gujarat, India to obtain the differences or similarities in the responses towards the questionnaire. The responses of 111 students have been collected. The online survey form has been designed to offer 19 questions on emotional, psychological aspects, and creative suggestions. The Chi-square method and standard deviation have been utilized for the analysis and interpretation of the data and to observe the degrees of differences or similarities in the reflections. The trends of suggestions on the specific situations are also analyzed by the Chi-square method and the standard deviation. The Chi-square analysis revealed that irrespective of the level of maturities, gender, semesters, and styles of learning, the responses are similar towards the questions related to the likes and dislikes of the remote teaching and largely owing to the sudden change in the conventional pedagogy, the students are not fully comfortable. On the other hand, a trend of similar suggestions to improvise the pedagogy of remote teaching has been observed.

Keywords: Remote teaching, Chi-square method, Engineering education, Emotional reflections, Psychological reflections, Online pedagogical practices

1. Introduction

Teaching engineering subjects through the online or remote platform has remained a challenge for either side

communities namely the teachers and the students. The challenges are enormous and the reasons are many. However, the success in the online pedagogy largely depends on the student's perception, preparedness, and cognitive abilities to learn with online lectures. Though the millennial learners are more tech-savvy and technologically equipped, the academic outcomes, the attainment levels and the degree of satisfaction of learning have been a concern by most of the academicians.

In recent months, the engineering educational institutes have been trying to shift the conventional mode of teaching to remote teaching platforms. On the other hand, for the learners; it may be a great emotional and psychological transition owing to the absence of friends, lack of a collaborative environment, a feeling of being alone in learning activities, etc. There has been a common point of discussion amongst the teachers that the recent trends of remote teaching-learning have influenced the learners and their learning capabilities to a great extent. This scenario demands a focused study on how the remote pedagogy has influenced the learners' cognitive abilities and thereby altered the attainment levels of the academic programs and what is the role of the emotional and psychological attributes of the learners in the remote pedagogy.

The academicians across the world have put efforts into exploring the influence of the emotional and psychological aspects of learners in the context of remote learning. Mixed responses and conclusions are revealing the brighter and darker sides of online learning according to past studies. The work done by (Petrović and Pale, 2015) revealed the contribution of the emotions and few psychological aspects behind the student's decision whether to attend the online sessions or not. It has been observed that punishing the students for absenteeism in the lectures encourages them to more negligence and an extent for the drop-outs also. Another study by (Bourne et al., 2015) reflected the promising future of online teaching at the engineering institutes, as the students have slowly started accepting remote teaching as one of the attributes of the teaching-learning processes. The article acknowledges the learning attitude of students as those who want to learn,

can always learn online also. The role of cognitive learning of students in remote teaching has been discussed by (Richardson and Newby, 2010) and it has been recommended that students like to get engaged by the instructors with good exercises and projects. Many attributes to increase the students' involvement in remote learning have been suggested in another study by (Robinson and Hullinger, 2010). However, the article deals with the suggestions and creative alterations required for the development of effective online lectures, there is a mention of students' perception towards the online study.

A comparative study of face-to-face and online teaching presented by (Zhan and Mei, 2013) revealed that the students expect more social presence in the online mode. The social presence has a strong impact on the learning achievement and satisfaction of online learners. The work observed that online learners required more attention compared to the students learning in a classroom environment. This is an important observation made by the authors and reveals the importance of the emotional and psychological parameters of the students in remote teaching. In a case study by (Rossiter, 2013) it has been indicated that the students were happy to receive access to the recorded videos of remote sessions. The customized way of watching the sessions is an important reflection of the learner's psychology towards online learning. Easy access to the uploaded documents and literature is an important part of remote teaching as mentioned in a study by (Christie and Jurado, 2009). The students utilized the supplementary materials extensively as per the results of the survey. This attitude by the students again emphasized the importance of the sense of personalization and being secured with the customized study material along with the online sessions. (Oerlemans et al., 2007) presented a study on a pilot project where the hybrid mode of teaching is employed in the academic activities for students (Online and face-to-face). Though the study did not directly approach the context of student's reflections on online learning, the work shows the importance of producing quality teaching materials for online modules and how it affects the learning of the students. The authors have mentioned that online learning provided greater flexibility to the students and made them happy to accept the model.

A study presented by (Polkowski et al., 2019) on the usefulness of peer learning in the engineering education pedagogies agreed to the fact that the students have started welcoming the technological advancement in the traditional teaching-learning processes and have shown active involvement due to the peer review based learning environment. This attitude shows the importance of the emotional engagement of the students while attending the online or remote teaching modules.

The literature survey provided varied outcomes on the student's involvement in remote teaching. While referring to the available research, it has been observed that there is a need for a study focused on the emotional and psychological parameters of the learners appearing in the remote teaching model. Most of the studies so far have been done on how to create good content, how to design the

online materials, and how to evaluate the students in the remote teaching pedagogical practices.

The authors are highly motivated and excited in producing the research based on the largely untouched area of how the emotional and psychological parameters of the student influence their cognitive learning capacities. A questionnaire containing important and focused questions has been prepared and circulated to 111 students of the Civil Engineering degree program at the Marwadi University to receive reliable reflections and opinions on the newly emerging mode of teaching as the remote teaching in the engineering educational institutes.

2. Hypothesis

This study is based on the hypothesis that the cognitive learning capacities of the learners while attending the remote teaching sessions are influenced by the emotional and psychological parameters developed in the learners. The study focuses on relating the learners' reflections, expressed in a questionnaire, the degree to which the learners have shown the agreements or disagreement on the questions, to what extent the reflections influence the learning on the remote teaching platform with the emotional and psychological parameters. Moreover, the survey included suggestions from the learners on the ongoing remote teaching activities by their teachers to unlock the hidden expectations from the video lectures. The authors have utilized the following hypothesis in the present study;

H1: The age and maturity levels of the students influence the remote teaching pedagogy.

H2: The students are glad and excited about the remote teaching initiatives by the institute (Emotional reflection).

H3: A two-way communication is necessary for remote teaching (Emotional reflection).

H4: The learners have their priorities for the contents shared at the remote teaching (Psychological reflection).

H5: The remote teaching changes the learner's cognitive styles (Psychological reflection).

H6: Remote teaching influences teaching quality.

H7: Overall, remote teaching is not a preferred learning option (Psychological reflection).

The suggestions to further improve remote teaching have been collected and mapped with the hypothesis of the requirements of quality teaching in remote or on-line classroom mode.

3. Method: The questionnaire design

The questionnaire has been designed to collect the similarities and variations in the opinions of the learners studying in the varying levels of semesters namely 3, 5, and 7. Moreover, the questionnaire offers an opportunity to share suggestions for possible improvements. A total of 19 questions have been included in the questionnaire. There have been stand-alone questions to reveal the emotional and psychological aspects. The learners' opinions on how the teachers have been teaching, do they allow two-way

communication, and what major changes have been noticed in the teaching styles and pedagogy are the examples of the questions dealing with the emotional and psychological aspects of the students. The suggestions have been categorized in many sub-parts namely “give an overall rating to the quality of teaching, what is your desired time limit for a video lecture, would you like it if all the teaching was delivered remotely, ..”. The questionnaire includes questions allowing the students to give ratings also on specific attributes namely rating for teachers’ responses, quality of delivered content, appropriate usage and clarity of language by a teacher, feel of up-gradation in cognitive abilities, the usefulness of the study material provided and many other similar questions. When the students are given a chance to evaluate the authorities and the survey is anonymous, the chances of genuine responses are very high and that is what the authors have received in this work.

4. Method of analysis

Three types of analysis have been performed on the results. The reason is the different nature of questions. The questionnaire is a combination of a poll, suggestions, and rating activities. Therefore the qualitative and quantitative results have been collected, analyzed, and interpreted contextually to the hypothesis made as to the base of the study. The Chi-square test analysis has been utilized to obtain the degree of significance and sensitivity of the responses, and opinions where the agreement and disagreement were the modes of answers. The standard deviation has been employed to the questions of rating and polls.

5. Results

5.1 Defined questions, polls, and opinions

The survey provided a total of 111 responses collected from the students of semesters 3, 5, and 7. The participation scenario is presented in Fig. 1. As expected in the hypothesis, the highest participation is by the senior students (Semester 7). Reflections from the senior students are very useful and important as far as the consciousness of quality teaching-learning practices is concerned. However, the reflections received from such a community are more technical, result-oriented, or less cognitive. On the other hand, the junior students from the first and second year of the program are more emotional for the pedagogical practices and sensitive also towards the attitude of the teachers while they teach. As an upset, however, herein the case the semester 5 students showed less interest in the survey. This may be due to their confused state of cognitive capabilities or lack of clarity on what exactly they wish to receive from the teachers in the remote teaching method.

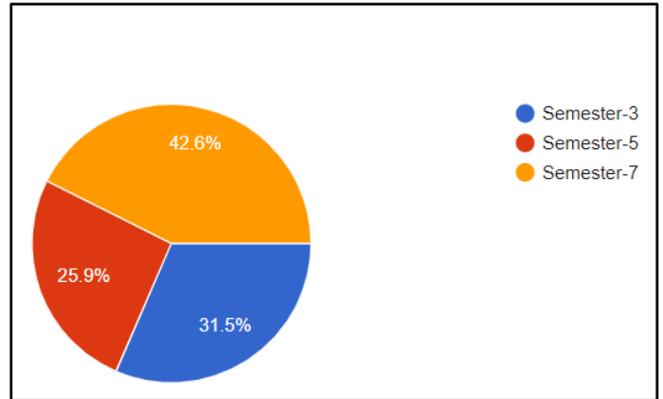


Fig.1 Participation scenario of the students

The second hypothesis on students’ first reaction when being offered the online classes showed an interesting reflection. As shown in Fig.2, the students were glad to have online lectures but with some reservations.

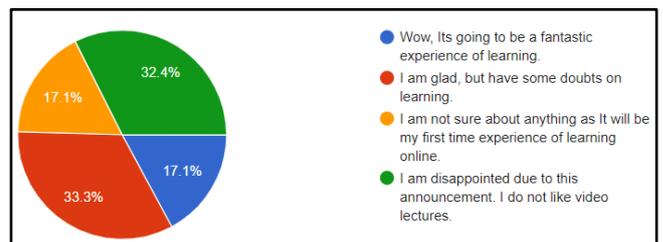


Fig.2 Students’ response to the commencement of the remote teaching

As discussed earlier, the remote teaching was a sudden shift to most of the students and they seemed not to be ready for the same. The answer to this question was the interpretation of the content being delivered at the online sessions by the teachers. The authors take it as an alarm for the academicians that designing, presenting, and narrating the contents requires careful observation of the students’ cognitive capacities. Importantly, the contents should be selected to cater to the varying style of the learners. Fig. 3 reveals this psychological reflection of the students.

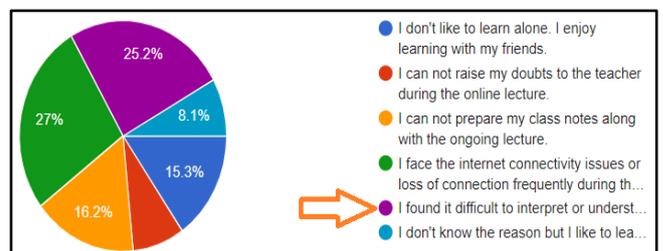


Fig.3 Students’ opinion on why they dislike the online sessions

Another technical reason for reservations by the students for remote teaching was internet connection services with the desired speed and data availability. Nearly 27% of the total students showed this reason against their level of comfort for remote teaching. This fact helps us understand the ground realities of the available infrastructure in our society.

On an emotional ground, students have expressed their urge to have two-way communication with the teacher while attending the remote sessions. Out of 111 students, 47.7% of students have mentioned that they are happy to have two-way communication with the teacher. However, this may not be a possible activity always for all teachers.

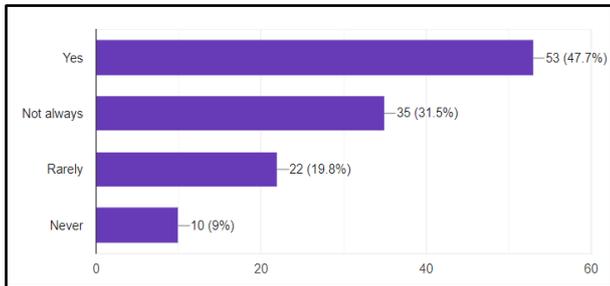


Fig.4 Reflection of the importance of two way communication

The reflections on how the content should appear in remote teaching have been loud and clear by the learners. As shown in Fig.5, 32.4 % of the total engineering students have shown their choice of content type as less text and more pictures and illustrations and 28.8% have expressed the need for numerical examples and demonstrative use of the contents over the plain text paragraphs. However, 14.4% of students have shown agreement to watch pre-recorded lectures also. These results expressed the psychological aspects of the likes and dislikes of the students on the contents. The results manifest the importance of articulated and creative ways of teaching complex subject information.

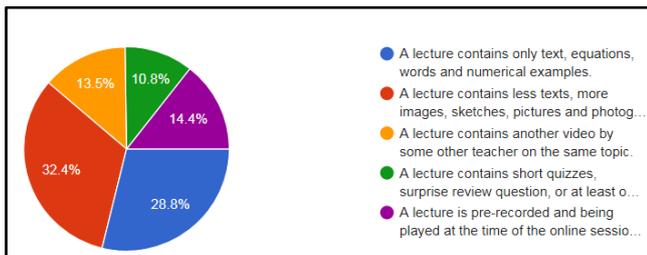


Fig.5 Learners' choice of content types for remote sessions

Remote teaching has largely influenced the cognitive capacities of the learners. The survey revealed that the ability to learn has been reduced dramatically. The reasons are both emotional and psychological. This scenario includes the reasons namely loss of interest (38.7%), and less attentiveness (32.4%). On the other hand, as a positive reflection, 18.9% of students agreed that they become more regular learners than ever and pay more attention to academics due to the online sessions. Moreover, around 9.9% have become ready to learn via a remote teaching platform for all the courses. This is to be taken as the positive impact of remote teaching for the future. Fig.6 shows the impact of remote teaching on the changed cognitive learning capacities of the learners.

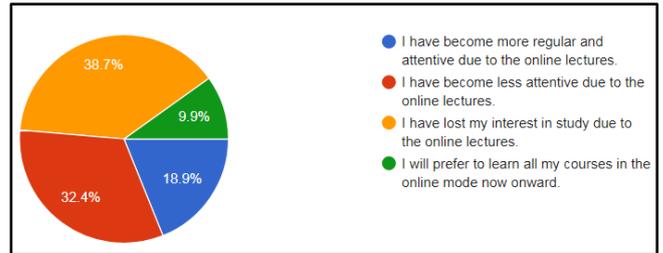


Fig. 6 Online teaching on cognitive learning capacities

The survey on the influence of remote teaching on the teaching quality and the overall success of this new pedagogy showed interesting results. Out of 111 students, around 58.6% of students mentioned that the teaching quality has declined due to the online sessions while 41.4% of students showed positive sides of the teachers during the online sessions. This is an alarming condition for the teachers. The authors believe that the response is not about the knowledge or teaching capacities of the teachers but it is largely about lack of adjustment to a new method of teaching, and about designing of the contents for the online teaching platform. Similar to the students, for many teachers, preparing a successful or learner-centric online session has been a challenge and since the shift was very sudden, the authors take this response as a learning step for teachers also.

In the final stage of the questionnaire, the students showed mixed responses for their overall experience of remote teaching. The students were asked to rate the remote teaching experience with a rating from 0 to 5. About 29.7% of the students rated their remote learning experiences as “good” with the rating of 3 out of 5, 12.6% and 7.2% students rated with excellent and outstanding respectively with 4 and 5 ratings. However, nearly 27% of students rated the remote teaching with a rating as “poor”. Although the students rated remote teaching with poor remarks, the reasons behind this may be highly varying in nature including personal preference, technical aspects, and learning habits and attitude of being flexible to a new way of pedagogy. The authors believe that with time and experience the students may eventually develop and divert their cognitive capacities according to the modern methods of teaching-learning processes. However, the teachers are bound to remain updated with the state of art remote teaching skills to accommodate a larger mass of learners with varying degrees of requirements from the online lectures.

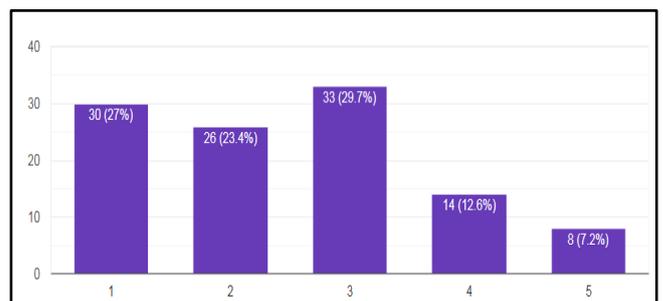


Fig.7 Overall rating of remote teaching

5.2 Suggestions received from the students

The present study has been focused on the student’s emotional and psychological involvement in remote teaching. To meet the requirements, a set of questions in the form of suggestions have been included in the questionnaire. Psychologically, inviting suggestions from the participants improves the level of involvement and the authenticity of responses. Table 1, shows the set of questions asking for the opinions of the students in terms of agreement or disagreement have been included in the study and further analyzed for necessary conclusions along with other analysis results.

Table 1. List of questions for students’ suggestions

| Sr.no. | Question |
|--------|--|
| 1 | The length of any online lecture should not be more than 30 minutes. |
| 2 | Only experienced or senior teachers should take the online sessions. |
| 3 | Only the teachers with good command of communication skills should only take online sessions |
| 4 | Only the teachers with good presentation and writing skills should only take online sessions. |
| 5 | There must be a short quiz after the completion of each online session. |
| 6 | A teacher should discuss at least five MCQ based on the contents delivered after each online session. |
| 7 | Minimum one hour is essential for any online session |
| 8 | A teacher should assign a review question in the middle of the online session and allow the student to answer during the session itself. |
| 9 | A teacher must circulate the recording or the content of the online session with the students. |
| 10 | There should be two-way communication between teacher and students during the online session |
| 11 | The teacher should provide a list of additional sources available of the materials for learning on the contents delivered. |
| 12 | Online learning is better to score more in the exams and tests. |

As mentioned in Table 1, the authors have put efforts to include the maximum aspects of the best acceptable online session model with varying degrees of agreement and disagreement by the students. A total of five options have been offered namely 1. Strongly disagree 2.Disagree, 3. May be or may not be (being neutral), 4. Agree, and 5. Strongly agree against each question. For the analysis of each statement, the Chi-square test method has been utilized to obtain the significance of a particular aspect of the online lecture from the student’s perspective. A sample analysis of the use of the Chi-square test has been shown below for question no.1 of the list presented in Table 1.

Question 1: The length of any online lecture should not be more than 30 minutes.

Table 2. Frequency of values obtained from the response

| Frequency | Str. Dis | Disagree | Neutral | Agree | Str. agree |
|------------------------|----------|----------|---------|-------|------------|
| Received response (fo) | 13 | 17 | 22 | 16 | 42 |
| Expected response (fe) | 22 | 22 | 22 | 22 | 22 |

Using the Chi-Square test formula;

$$\chi^2 = \sum (fo - fe)^2 / fe$$

Degree of freedom: (No. of rows-1) x (no. of col.-1)

The Chi-square value obtained from the formula: 24.64 and the degree of freedom is 4. Table 3, as shown below shows the sensitivity of the suggestions according to the Chi-square value at the constant degree of freedom as 4.

Table 3. Chi-Square value distribution of statements

| Stat. no. | Chi-Square distribution value | Remarks |
|-----------|-------------------------------|---------------------------------------|
| 1 | 5.95287E-05 | The null hypothesis is not acceptable |
| 2 | 0.001184619 | The null hypothesis is not acceptable |
| 3 | 4.49451E-06 | The null hypothesis is not acceptable |
| 4 | 1.09819E-05 | The null hypothesis is not acceptable |
| 5 | 0.220462523 | Significant variation of opinions |
| 6 | 0.00925569 | Significant variation of opinions |
| 7 | 0.588698305 | Significant variation of opinions |
| 8 | 0.192461214 | Significant variation of opinions |
| 9 | 1.20969E-10 | The null hypothesis is not acceptable |
| 10 | 3.80118E-08 | The null hypothesis is not acceptable |
| 11 | 2.23769E-11 | The null hypothesis is not acceptable |
| 12 | 2.99538E-08 | The null hypothesis is not acceptable |

Table 3 shows the significance of the hypothesis and the importance of the distribution value obtained from the Chi-square test method against the null hypothesis. Wherever the value of the distribution is negligible, the hypothesis can be rejected and the actual reflections are to be considered for the interpretation of results. on the other

hand, the higher level of distribution values shows the variation in the opinions and suggestions. The authors noticed that such variations are significant in the case of the quizzes and integrated review questions to be proposed to the students during the remote sessions. This is due to the reason that the students are psychologically affected by the new system of the pedagogy and not sure about the learning achievements through this medium and having a feel of shyness and hesitation of being incorrect in responding to the questions and by that may further lose the faith of teacher and colleagues.

6. Analysis and discussion of results

A wide range of responses, polls, opinions, and suggestions have been received from the respondents. The study included specific questions revealing the likes and dislikes of the respondents on remote teaching based on the questionnaire dealing with the emotional and psychological aspects of the learners. The hypothesis presented in the study have been confirmed from the responses and the standard deviation of the results are presented in Table 4 below.

Table 4. The standard deviation of the respondents

| Statement / Hypothesis | Standard deviation value |
|--|--------------------------|
| First response by learners on remote teaching | 10.11 |
| Learners' reasons to dislike remote teaching | 09.01 |
| Importance of two way communication and its requirement in remote teaching | 18.42 |
| Learners' choice on the content type for remote teaching sessions | 10.96 |
| Changes noticed in the cognitive learning capacities and styles of learners due to online lectures | 14.45 |
| Overall rating on remote teaching pedagogy | 10.73 |

As shown in Table 4, the responses of the students irrespective of the semester levels have been similar contextually to the standard deviation values obtained from the result analysis. However, it is to be noted that the importance of two way communication has emerged as a nonsimilar response being a part of the hypothesis. This may be due to the cognitive practices of the students at individual levels and reflects that the learning styles of the students may not be directly dependent on the way or mode of communication with the teachers at remote teaching. Moreover, the standard deviation values differed from the average values in case of changes in the cognitive learning capacities and styles of the students. The hypothesis on this point was that remote teaching influences the individual learning habits of the students and tends to change them due to the new model of pedagogical practices. However, the analysis suggested that remote teaching has not influenced cognitive capacities directly. On the other hand, the reflections presented in Fig.6, highlights that the remote teaching has influenced the attitude of students of attending the classes or sessions due to the change in the mode from

actual class to the online class. This is a factor dealing with the psychological attribute and as a system, it has to be further analyzed with a focused search for the reasons behind such an attitude of the learners.

6.1 Discussion of suggestions from the students

The list of suggestions included 12 different statements as shown in Table 1. The statements are designed according to the hypothesis that the ongoing remote teaching requires improvement and the students may be the better source of suggestions being the end-users of the remote sessions. Following are the responses received on the individual suggestions by the learners shown in Fig.8 to Fig.12. Here the legends 1 to 5 represent the degrees of disagreement to the agreement respectively and the statements are in order as per Table 1 starting with S1 to S12.

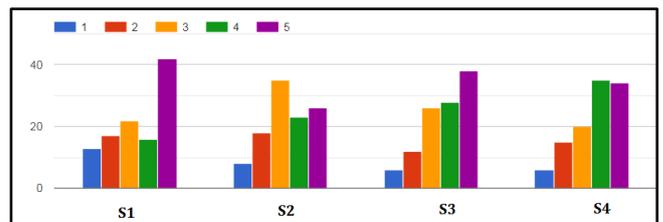


Fig. 8 Suggestions on statements 1 to 4

The reflections received in Fig.8 suggest that 42% of the students think of the reduced length of the sessions up to 30minutes. However, the learners have shown a neutral opinion for having only experienced teachers should teach them on online sessions. This indirectly shows the supportive role of technology to empower the teachers to overcome the limitations of class engagement during physical classes. The students have made a clear choice on the communication skills and presentation skills of the faculty members in the response of statements 3 and 4 and it is emphasized by nearly 38% and 35% of the students respectively.

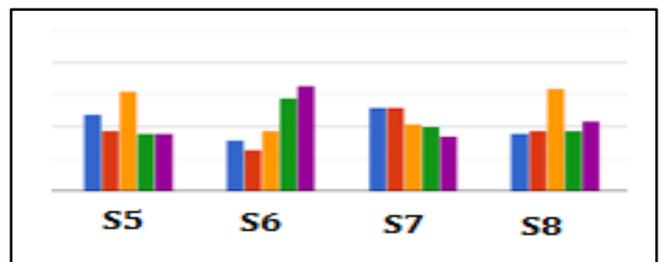


Fig.9 Suggestions on statements 5 to 8

As shown in Fig.9, regarding the integrated quiz offered during the online sessions, nearly 31% of students have remained in neutral positions and 24% of students disagreed with the quiz during the session. This may be due to the limitations of attentiveness by the students for remote teaching. earlier, the authors have noticed that students face connectivity issues also for their internet. This may be another reason for the ignorance of the quiz. For statement

6, nearly 33% of students agreed to have multiple-choice questions being discussed during the remote sessions. This suggestion is very important and reveals the necessity of the collection of MCQ data banks. This is a long time learning that for each subject being offered as a remote session must have at least 50 to 100 MCQ covering the entire syllabus of the subject or course. Regarding the review question in the middle of the session, students again showed a neutral approach, but 20% of the students showed interest in this activity.

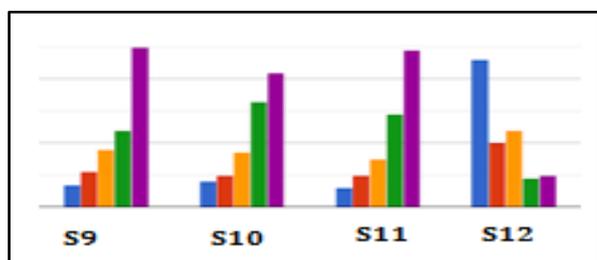


Fig.10 Suggestions on statement 9 to 12.

Statements 9 to 12 received maximum attention from the students. Nearly 50% of students suggested that teachers must circulate the recordings of the remote sessions. This is a psychological reflection of the students showing their sense of security. The possession of the recording enables the safeguard to the students and provides a flexible learning environment. Similarly, for statement 10, nearly 42% of the students suggested the importance of two-way communication in the remote teaching sessions. In statement 11, 49% of the students suggested that teachers should provide a list of additional reading sources and study materials for the contents discussed in the remote session, and finally, nearly 46% of the students agreed that online learning is not a preferred option for exam related preparation.

The questionnaire provided several important information on what exactly the students feel about remote teaching and what are their emotional as well as psychological concerns. The suggestion part revealed the emotional aspects of the students as to what they expect from the remote session for a specific course or program.

7. Conclusions

The present study has been focused on revealing the emotional and psychological attributes of the learners during their participation in the remote sessions. The study has collected and analyzed the reflections obtained from the anonymous survey in the student community of a bachelor's degree program in Civil Engineering. The analysis has been carried out by result observations, chi-square method, and standard deviation of the reflections. The students have reflected on their opinions, priorities, likes, and dislikes along with the suggestions for the betterment of the remote sessions. based on the reflections collected, the followings are the conclusions made from the study;

- a. Maximum participation has been observed from the students of the pre-final year.
- b. The students have shown a mixed reflection of positive and negative 33% and 32% agreement respectively on their readiness for the remote sessions.
- c. The internet connection and consistency have remained a major point of concern for the students during remote teaching and this is a psychological reason behind the negative reflection on the acceptance of remote teaching.
- d. Students have shown their concern for the interpretation of the content being delivered and urged to have recordings, supplementary reading material, and sources of information from the teachers on the contents. This is reflected in the context of the emotional needs of security and safety from the students.
- e. Two-way communication is a primary requirement by the students attending remote sessions to cater to their emotional and psychological requirements.
- f. The content should have more illustrations, pictures, and animated video content in the remote sessions as per the overall opinion of the students.
- g. Nearly 32% of the students have shown their concern regarding the changed cognitive styles of learning due to the remote teaching platform. The reasons are primarily the new platform, issues of internet facilities, and required alteration of the habits of learning styles.
- h. Overall the ratings for remote teaching pedagogy have been good from the students. The chi-square method of analysis ensured that the hypothesis made by the authors have been effectively conveyed to the students in a present survey.
- i. The students have made several creative suggestions to improve the remote sessions and the same has been observed by the authors as helpful tips to enhance the remote sessions to obtain a better level of attainment in the new pedagogical practices.
- j. Overall, the survey revealed that a sudden shift in the conventional pedagogical practices has influenced the emotional, psychological, and cognitive learning capacities of the students though, with the effective presentations, modified and learner-centric contents, and the supplementary guidance to the students, the limitations and constraints can be overcome effectively.

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References

Petrović, J., & Pale, P. (2015). Students' perception of live lectures' inherent disadvantages. *Teaching in higher education*, 20(2), 143-157.

Bourne, J., Harris, D., & Mayadas, F. (2005). Online engineering education: Learning anywhere, anytime. *Journal of Engineering Education*, 94(1), 131-146.

Richardson, J. C., & Newby, T. (2006). The role of students' cognitive engagement in online learning. *American Journal of Distance Education*, 20(1), 23-37.

Robinson, C. C., & Hullinger, H. (2008). New benchmarks in higher education: Student engagement in online learning. *Journal of Education for Business*, 84(2), 101-109.

Zhan, Z., & Mei, H. (2013). Academic self-concept and social presence in face-to-face and online learning: Perceptions and effects on students' learning achievement and satisfaction across environments. *Computers & Education*, 69, 131-138.

Rossiter, J. A. (2013). Using online lectures to support student learning of control engineering. *IFAC Proceedings Volumes*, 46(17), 132-137.

Christie, M., & Jurado, R. G. (2009). Barriers to innovation in online pedagogy. *European Journal of Engineering Education*, 34(3), 273-279.

Oerlemans, K., May, E., & Hurle, B. (2007). Piloting online learning in engineering education. In *AARE 2007 International Educational Research Conference* (Vol. 1, pp. 1-9).

Polkowski, Z., Jadeja, R., & Dutta, N. (2020). Peer Learning in Technical Education and it's Worthiness: some facts based on implementation. *Procedia Computer Science*, 172, 247-252.

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